

PROCEEDINGS OF THE
ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 72

MARCH 1970

No. 1

LEAFHOPPERS OF THE *AGALLIOPSIS NOVELLA* COMPLEX
(HOMOPTERA: CICADELLIDAE)^{1, 2}

PAUL OMAN, *Department of Entomology, Oregon State University,
Corvallis, Oregon 97331*

ABSTRACT—The *Agalliopsis novella* complex, comprised of 11 New World species, is defined in morphological terms and bases for differentiation of members of the complex from other agallian leafhoppers cited or summarized. All known members of the complex are described and illustrated. Three taxa, *emulata* Oman, *tropicalis* (Van Duzee) and *vicosa* Oman are elevated from varieties of *novella* (Say) to specific rank, and the following new species described: **reflexa** (Venezuela), **hamatilis** (Mexico), **stella** (Texas), **ancistra** (many localities in temperate North America; type locality Green Mts. near Rutland, Vermont) and **abietaria** (numerous localities in northwestern North America; type locality, Corvallis, Oregon).

The treatment of *Agalliopsis novella* (Say) in my classification of North American agallian leafhoppers (Oman, 1933b)³ left much to be desired. The great range of shape in certain structures of the male genitalia (p. 24), five types of which were illustrated (fig. 14F, G, H, I and J), led me to suspect the existence of several discrete biological entities. However, these segregates were not then named because the material available seemed insufficient for a suitable interpretation of the species complex. Some of the more distinctive members of the complex have since been described, but none of the several segregates illustrated in my 1933 paper save *tropicalis* (Van Duzee) has yet been named. The existence of a species complex seems evident, and since one member of the complex, *novella* s. s., has been intensively investigated as a vector and host of plant-pathogenic viruses, a reliable basis

¹ This study was supported in part by Grant GB-7706 "Phylogeny and Distribution of Nearctic and Palearctic Leafhoppers," from the National Science Foundation. A literature search was aided by a Grant-in-Aid from the General Research fund of the Oregon State University. Publication costs were paid from Grant GB-7706.

² Immediate publication secured by full payment of page charges—Editor.

³ Complete references to literature prior to 1956 will be found in Metcalf's Bibliography of the Cicadelloidea, 1964a, and Fasc. VI Part 14, Agalliidae, of his General Catalogue of the Homoptera. References to pertinent publications appearing subsequent to 1955 are given under "References."

for species discrimination is needed. This paper summarizes current taxonomic understanding of the complex.

Agalliopsis Kirkaldy belongs to the subfamily Agalliinae, the New World genera of which have recently been reviewed by Kramer (1964a). As currently interpreted, *Agalliopsis* occurs only in the New World. *Agalliopsis fasciata* Osborn (1934a:164) from Samoa is removed from *Agalliopsis* because Osborn's illustration shows the crown not extended laterally behind the mesal margins of the eyes, the ocelli close together, and the face wider in proportion to the length than is the case in *Agalliopsis*. The species was described from a single female. No doubt other and better differentiating characters will be apparent when additional specimens, including males, are available for study. I suspect *fasciata* to belong to the Australasian fauna, but for the present its generic position is uncertain.

Japanagallia Ishihara (1955a), type-species *Agallia pteridis* Matsumura (1905a) from Japan, resembles some members of *Agalliopsis* subgenus *Agallaria* in general shape and in having the posterior margin of the crown slightly sinuate laterally. *J. pteridis* also has the male style enlarged and convoluted distally somewhat as in *Agallaria*. But in *Japanagallia* the Xth segment is only weakly developed in the male, the pygofer has a pair of posteriorly-directed pointed lobes next the anal tube, and the aedeagus is stout with a large basal atrium. The superficial resemblance between *Japanagallia* and *Agalliopsis s. l.* is therefore more likely evidence of convergent evolution than indicative of close relationship.

Kramer's key will serve to differentiate *Agalliopsis s. l.* from other New World agallian leafhoppers. The *novella* complex belongs to *Agalliopsis s. s.*, which differs from other members the genus in the structure of the style of the male genitalia. In *Agalliopsis s. s.* the style is divided into two parts joined by a fibrous section that permits the mesal piece to move (figs. 7F, 7Fa). In the subgenus *Agallaria* Oman (1949a:36), and all other related species I have studied, the style is not divided. This unusual characteristic of the style in *Agalliopsis s. s.* was first pointed out by Lawson (1920a:56) who stated that the style of *novella* was "composed of two unequal pieces, the larger ventrad of the smaller," an observation that I disputed (Oman, 1933b:6). I now consider Lawson's interpretation to be essentially correct, in that the connection between the parts of the style is such that the one can be moved, rather than the style being only slightly sclerotized along the midline as I thought.

I consider the unique type of style in typical *Agalliopsis* a highly specialized development. It presumably evolved from a type of style similar to that found in *Agallia*, *Agalliopsis* subgenus *Agallaria* and some other agallian leafhoppers, in which the terminal part of the style

is twisted first mesad and cephalad, then curves dorsad and finally caudad, so that the apex of the style opposes a rounded lobe formed at the first bend in the axis of the style. The chelate structure found in typical *Agalliopsis* (figs. 7F, 7Fa) presumably developed through loss of sclerotization where the style first bends mesad, together with a cephalic elongation of the inner lobe.

There are three distinct evolutionary lines in the typical subgenus *Agalliopsis*; one represented by *novella* and closely related species, referred to as the *novella* complex and characterized below, a second by *inscripta* Oman⁴ and *gavia* Kramer, and the third by *variabilis* Oman, *saxosa* Ball and an undescribed species from Sonora, Mexico. The *inscripta* and *variabilis* groups lack the enlarged male genital capsule characteristic of the *novella* complex, but *inscripta* and *gavia* have a female sternum VII similar to that of *tropicalis* of the *novella* complex.

The *novella* complex is presumed to have evolved from ancestral forms the males of which were somewhat like those of *inscripta* and *gavia*, in which the pygofer hook first developed as a sclerotized area on the inner surface of the reflexed posterior margin of the pygofer and the posterior-dorsal margin of the pygofer subsequently expanded to form the caudo-dorsal lobe found in *novella* and relatives. The *novella*-type aedeagus, with basal processes lying along the ventral part of the shaft, could conceivably have evolved from a very broad aedeagus, similar to that found in *inscripta* and *gavia*, through dorso-ventral expansion of the median part, and reduced sclerotization of the area between the gonoduct and the lateral flanges, the latter eventually becoming separate processes.

The *novella* complex may be characterized as follows: Medium to small leafhoppers, ranging in length from 3.0 to 4.75 mm.; in width, measured across the eyes, from 1.0 to 1.3 mm. Uniformly slender wedge-shaped as seen from above, the length to width proportions nearly constant; in lateral view head and thorax relatively deep, forewings narrowly rounded apically. Crown very short, about 1½ times as long laterally as medially, the posterior margin slightly sinuate laterally and extending behind the eye. Pronotum strongly arched, hind margin straight medially but curving forward laterally to meet the anterior margin at the posterior edge of the eye. Forewing with three anteapical cells, the inner one open basally except in *vellana* Ball.

Male genital capsule (fig. 10G) disproportionately large in comparison with remainder of abdomen, the short, distally rounded plates usually not completely covering the caudo-ventral opening; plates usually bearing a row or tuft of very fine setae on the posterior margins laterally; pygofer extended posteriorly as paired oval or elongate-oval lobes from the inner faces of which arise the pygofer hooks; outer surface of lobes often with a few very small but stout setae along posterior submargin. A membrane connects the ventral margin of the lobe to the caudo-ventral margin of the pygofer (fig. 10Db). Tenth segment (dorsal view, fig. 7Cb)

⁴ Descriptions and illustrations of the male genital structures of *inscripta* are given by Kramer, 1960a:64-65 and 1964a: pl.XII, figs. 26, 27.

not closed posteriorly (the morphological ventral), and in the form of a collar with the posterior ends variously modified. Aedeagus (figs. 7A, 7B) stout, roughly U-shaped in lateral view, the aedeagal shaft forming the ventral arm and bearing a pair of (usually) slender processes that arise from the caudal wall of the basal atrium and extend caudad; processes usually at least half as long as shaft but reduced in *novellina* Oman; surface of aedeagal shaft often with numerous minute rounded or subangular projections called corniculi. The gonoduct traverses the ventral part of the shaft of the aedeagus, opening through the gonopore on the ventral side well before the apex. Style (figs. 7F, 7Fa) consisting of two articulated parts; these lie generally with the long axis of the body but the mesal part is slightly twisted distally so it lies dorsal of the main part of the style which terminates in a blunt lobe the inner surface of which has a row of from 3 to 10 or more fine setae, these usually visible only with good light at 100 diameters or more magnification. Connective inverted Y-shaped, with base of the Y very broad, the arms short.

The entire assemblage of concealed genitalic structures, comprised of the styles, connective and aedeagus, is moveable and anchored within the genital capsule primarily at three points. The dorsal arm of the aedeagus is connected to the inner surface of the anterior (morphological dorsal) arc of the Xth segment by a thin, flexible membrane. The lateral part of each style is connected to the plates, laterally, at their junction with the valve of the capsule. The lateral part of each style is in turn attached to an arm of the inverted Y-shaped connective, to the opposite end of which the aedeagus is attached. It is usually necessary to remove these concealed genitalic structures from the genital capsule for critical examination. With a little practice and luck this can be done, without tearing the genital capsule of a macerated specimen, after severing the connective tissues at the points indicated with very fine needles.

Female sternum (figs. 1E, 7E) large, usually extended posteriorly and often greatly expanded laterally as well, shallowly or deeply emarginate posteriorly.

Color exceedingly variable in intensity but pattern constant when markings are present. General ground color from pale cinereous to dark brown, males usually consistently darker than corresponding females from the same populations. Markings, which may range from very faint yellowish tan to fuscous, consist of the following: facial sutures and inverted Y on crown and face above the level of the ocelli, a small spot at the inner margin of each ocellus and an irregular spot at the inner margin of each eye. Most of the Neotropical species have the apex of the anteclypeus and its lateral margins distally fuscous or dark brown, a condition seldom found in the Nearctic species. Median line of pronotum and a spot on each side of the median line about equidistant between front and hind margins and the midline and lateral margin; in darker male specimens these pronotal spots may be broadly bordered by a pale area with the rest of the pronotum infuscated, or sometimes the spots may be fused posteriorly with the extensive fuscous markings. The general pattern of head and pronotal markings, which will usually serve to differentiate members of the *novella* complex from other *Agalliopsis*, is illustrated by Oman (1933b, pl. 1D). Forewings usually with an elongate smoky spot on the commissural margin between the two claval veins, remainder of forewings sometimes variously infuscated but lacking a consistent pattern; veins pale except base of R + M to beyond the fork which is usually brown in males and occasionally in females of some species. Hind wings smoky, veins dark.

The existence of a color mutant "maroon" in a laboratory colony of *novella* has been reported by Teitelbaum and Goulet (1950a). In this mutation the normally buff colored legs are dark, and the thoracic segments, especially ventrally, are darkened to various degrees. Inheritance of this color characteristic was found to be determined by a single recessive autosomal gene. This variation in color is evident in nymphs as well as adults.

Inter-relations among the taxa comprising the *novella* complex are at best obscure. The observed variation in color and structural details within populations of known ancestry or within populations from very limited natural areas suggests extreme genetic plasticity throughout the group. Therefore it is not surprising to find that evidence indicating probable relationships among the several elements forms a very complex web. A few examples will illustrate the situation.

A. novellina, *vicosa* Oman and *emulata* Oman all have the aedeagal shaft very broad dorso-ventrally, the apex of the Xth segment blunt and female sternum VII only shallowly emarginate. *A. reflexa*, n. sp., has the aedeagal shaft somewhat broadened, and the Xth segment is similar to that of *vicosa*. But in the shape of the basal aedeagal processes there is no similarity between the condition found in *novellina*, where those structures are short and vane-like, and in *vicosa* and *emulata* where those structures are slender, attenuated and closely appressed to the aedeagal shaft. But the female sternum VII of *emulata*, though only shallowly emarginate, is expanded laterally as in *novella*. The pygofer hook of *emulata* is very different from that of *vicosa*, while the hook in *reflexa* resembles that of *vicosa* in shape, although differently oriented. The aedeagal processes of *reflexa* are more like those of *hamatilis*, n. sp., and the variants of *tropicalis* in which the apex of the process is expanded and angled.

A. tropicalis and *hamatilis* resemble one another in shape of the Xth segment of the male and general pattern of aedeagal structure, but the latter has a pygofer hook reminiscent of that of *novella*, while the hook in *tropicalis* is more like that of *vellana*. Female sternum VII is not emarginate posteriorly in *tropicalis* (female of *hamatilis* not known), and resembles that of *reflexa* rather than that of *novella*.

The aedeagal processes are close to the aedeagal shaft in dorso-ventral view in *vicosa*, *emulata*, *reflexa*, *tropicalis* and *hamatilis*, and diverging from the shaft in *novella*, *vellana*, *stella*, n. sp., *ancistra*, n. sp. and *abietaria*, n. sp., but no other character or set of characters results in a similar grouping of species. Contradictory evidence of this sort regarding relationships exists throughout the complex.

Specific concepts adopted in this paper have been considerably influenced by the evidence available from laboratory cultures of *novella*. Samples from those cultures, the progeny of adults reared from a total of 47 nymphs, show essentially the same range of color and structural

variation encountered in field collected material from throughout the range of the species, and I find no evidence that *novella* intergrades with any other of the taxa recognized.

There is a voluminous literature dealing with members of the *Agalliopsis novella* complex, most of it cataloged (Metcalf 1966a:95-102) under the name *novella*. Many of these publications contain references to the ecology of the species, but there is surprisingly little information recorded about details of biology or behavior of any member of the complex, even though *novella* has been used experimentally as a vector of phytopathogenic viruses for some 27 years, during which time one or more colonies of the species have been constantly maintained. Osborn and Ball (1898d:48) recorded that the species⁵ overwinters as nymphs, and that the adults mature early in the summer. The scanty evidence available suggests that this is the general pattern of life cycle of all species that occur in the northern latitudes or high altitudes in the north temperate region. They appear to be primarily univoltine although some populations of *novella* apparently are not. Nymphs of *abietaria* occur in November but adults have been found only in spring and early summer. Adults of *vellana*, a subtropical species, apparently occur throughout most of the year and the species is presumed to be multivoltine.

No certain knowledge regarding host plants for species of this complex is available. Ball (1936e) summarized knowledge of the food plants of species of *Agalliopsis* that occur within the United States. It is noteworthy that positive associations are given only for species of the subgenus *Agallaria*, many of which live on woody plants, and for members of the *variabilis* group. Blocker⁶ has found adults and some nymphs of *novella* associated with stinging nettle, *Urtica dioica procera* (Muhl.) Wedd., along the Kaw River in the vicinity of Manhattan, Kansas in May, and *Urtica* may play an essential role in the life cycle of the species. However, the late summer/early fall developmental period reported (Osborn and Ball, 1898d) for nymphs of *novella* makes it seem unlikely that *Urtica* is the host upon which the immature stages normally live, for at that time of year the plants would usually be too old to serve as suitable hosts. Moreover, stinging nettle is a plant naturalized from Eurasia and thus not native to the faunal region inhabited by species of the *novella* complex. Three of the north temperate zone species, *novella*, *ancistra* and *abietaria*, have been reported from flood plain habitats where species of *Urtica* might be presumed to be common, but I have failed to find *abietaria* associated with stinging nettle in Oregon.

⁵ The Osborn and Ball record from Iowa might pertain to either *novella* or *ancistra*, presumably the former species because of the size indicated.

⁶ Personal communications from H. Derrick Blocker to Oman dated March 18 and June 10, 1969.

Nymphs of *novella* are distinctive in appearance (Osborn and Ball, 1898d: pl. I, fig. 2; Oman, 1949a: pl. 2, fig. 3), and nymphs of other species of the *novella* complex are presumed to be similar.

The following observations concerning the mating of *Agalliopsis* are based upon study of pairs killed *in copula*. Mating is in an end-to-end position, or as the abdomens become elevated from the substrate, partially venter-to-venter. *In copula* the plates of the male are ventral to sternum VII of the female. The male's styles may clasp the margin of female sternum VII, or they may lie ventral to it; this point could not be determined with certainty, but the former arrangement seems more probable. The male pygofer clasps the lateral margins of female sternum VII and the adjacent pleurites, with the expanded terminal pygofer lobes of the male closely appressed to the pleurites. The pygofer hooks are appressed to the pleurites of the seventh segment of the female at their junction with the tergum. The terminal hooks of the male Xth segment engage the cephalic margin of the female segment XI, and the aedeagus is inserted between the valves at the very base of the ovipositor. The small paired tubercle-like processes on the posterior surface of male segment XI are in contact with the ovipositor at the base of female segment XI. The hind legs of the female are in contact with the plates of the male, with the apices of the tibiae against the base of the plates and the tarsi extended laterad or caudo-laterad to the pleurite of the female and the pygofer of the male.

The clasping function of the pygofer hooks is presumed to account for at least some of the broken pygofer hooks observed, primarily in specimens of *ancistra* in which the very slender processes that occur in some representative of that species are sometimes broken off.

The verbal descriptions are supplemental to the illustrations, and deal primarily with the structural features thought to be useful for species definitions and differentiation. In describing paired structures, such as the pygofer hooks, the terminal parts of the Xth segment and the aedeagal processes, the singular is used in the interest of conciseness of expression, even though the descriptive matter applies to both the paired structures or the two sides of a single structure. No attempt is made to give a detailed description for the complex and variable pygofer hooks other than to indicate their general orientation with respect to the body axis, and their general shape. The pygofer hooks of no two individuals of a species seem to be essentially identical in shape, and there is even considerable individual variation in the serrations of the hooks, so that one hook is seldom a reasonably exact mirror image of the opposite member. Figure 10Dd illustrates the degree of individual variation in hooks that is sometimes found in a single specimen. Comparable though less evident variation occurs in the terminal part of the Xth segment, and in the tips of the aedeagal processes.

The orientation of the pygofer hooks is subject to some variation due to the flexing of the pygofer lobes to which they are attached. The descriptions indicate the usual condition. In the descriptions the part of the pygofer hook nearest the point of attachment to the pygofer is referred to as the arm. The arm lacks serrations or similar irregularities. The terminal part of the hook may be extended either dorsally or ventrally from the arm, or both, and the mesal margin is usually serrate or dentate.

Outline drawings of the aedeagi, dorsal and lateral, are for the most part self explanatory. Pigmentation is usually not shown except as dotted lines may indicate limits of pigmented and unpigmented areas. Aedeagal corniculi are shown in some illustrations, but unless conspicuous under magnification of about 100 diameters are not usually indicated.

Outline drawings of Xth segments are from the left side; thus the left margin of the drawing represents the tergal margin of the segment.

Illustrations of pygofer hooks are outlines of the hook in whatever orientation is required to place the structure as nearly as possible in a single plane. The approximate orientation is given in the descriptions of the appropriate species. The right hook is depicted unless otherwise indicated.

The seventh sternum of the female, referred to in descriptions as sternum VII, like virtually all other features used for definition of species, varies considerably in exact shape. The illustrations depict the outline as accurately as possible, but the degree of curvature in the segment, which varies from individual to individual, sometimes tends to accentuate or lessen the impression of features such as proportion of depth to width of median emargination and degree of sinuation of the posterior margin.

Specimens that have been used for preparation of illustrations are identified by a small yellow label "Illustrated, Oman 1970" affixed to each pin. In addition, the locality data are given in the record of illustrations, and the place of deposition of specimens indicated by the appropriate institutional code in parentheses.

I am grateful to numerous individuals and institutions for the loan of specimens upon which much of this study was based. Approximately 2000 specimens have been examined during the course of the work. The following code letters are used in connection with the descriptions to designate the collections in which types or other specimens of particular significance are deposited: American Museum of Natural History (AMNH); Canadian National Collection (CNC); Illinois Natural History Survey (INHS); Kansas State University (KSU); Mervin W. Nielson (MWN); Ohio State University (OSU); University of Arizona (UA); University of Kansas (UK); United States National Museum

(USNM). I have also studied material in the collections of Dwight M. DeLong, North Carolina State University, Oregon State University, Pennsylvania State University and the University of Kentucky.

Diagnostic keys are of questionable value in a group such as the *novella* complex where there are extremes of infraspecific variation and the structural features often defy concise description. In the following key the part dealing with males is intended primarily as a guide in interpreting the illustrations, which offer the best assurance of conveying specific concepts. Differentiation of some of the females is virtually impossible unless they are associated with males, and then identification may be doubtful unless one is very familiar with different members of the complex.

KEY TO SPECIES

1	Inner antepical cell of forewing closed basally	<i>vellana</i> Ball
1'	Inner antepical cell of forewing open basally	2
2 (1')	Males	3
2'(1')	Females	12
3 (2)	Basal processes of aedeagus vane-like, less than one-fourth length of aedeagal shaft (figs. 1A, 1B)	<i>novellina</i> Oman
3'(2)	Basal processes of aedeagus not vane-like, at least half as long as shaft	4
4 (3')	Pygofer hook without a definite arm	5
4'(3')	Pygofer hook with a definite arm	6
5 (4)	Serrate margin of pygofer hook directed meso-caudad (fig. 2D)	<i>viciosa</i> Oman
5'(4)	Serrate margin of pygofer hook directed meso-cephalad (fig. 3D)	<i>reflexa</i> , n. sp.
6 (4')	Basal processes of aedeagus, as seen from above, appearing to lie close to the shaft	7
6'(4')	Basal processes of aedeagus not close to shaft	9
7 (6)	Shaft of aedeagus very broad in lateral view, at least one-third as broad as long (fig. 4A); pygofer hook with a slender, unserrated dorsal extension and a broader, deeply serrate ventral extension (fig. 4D)	<i>emulata</i> Oman
7'(6)	Shaft of aedeagus not over one-fourth as broad as long; dorsal part of pygofer hook much broader than part below arm	8
8 (7')	Dorsal extension of pygofer hook at right angle to arm, no ventral extension (fig. 6D)	<i>hamatilis</i> , n. sp.
8'(7')	Dorsal extension of pygofer hook directed obliquely mesad from arm, a short ventral process present (fig. 5D)	<i>tropicalis</i> (Van Duzee)
9 (6')	Basal processes of aedeagus angularly expanded distally	10
9'(6')	Basal processes of aedeagus not angularly expanded distally, at most slightly swollen	11
10 (9)	Apex of aedeagal process obliquely truncate but not attenuated, mesal and lateral angles approximately equal (figs. 11A, 11B); pygofer hook small and entirely ventral to arm (fig. 11D)	<i>abictaria</i> , n. sp.
10'(9)	Apex of aedeagal process usually attenuated and sharply pointed, mesal angle always obviously sharper than lateral angle (figs. 10A, 10B); pygofer hook variously shaped, usually some part dorsal to	

- the arm or at least with a meso-dorsad extension (fig. 10D)
 **ancistra**, n. sp.
- 11 (9') Pygofer hook extending dorsad at right angle to arm, never with more than a slender spur ventral to the arm (fig. 7D) **novella** (Say)
- 11'(9') Pygofer hook about equally above and below the arm (fig. 9D)
 **stella**, n. sp.
- 12 (2') Apex of anteclypeus fuscous or dark brown; sternum VII never deeply emarginate posteriorly 13
- 12'(2') Apex of anteclypeus not fuscous or dark brown; sternum VII deeply, moderately or shallowly emarginate posteriorly 15
- 13 (12) Sternum VII slightly expanded laterally beyond pleurites; posterior margin shallowly emarginate but not sinuate laterally (fig. 4E)
 **emulata** Oman
- 13'(12) Sternum VII not expanded beyond pleurites; posterior margin sinuate laterally or not 14
- 14 (13') Posterior margin of sternum VII usually sinuate laterally (figs. 3E, 5E); Venezuela, Jamaica and Costa Rica
 **reflexa**, n. sp. and **tropicalis** (Van Duzee)
- 14'(13') Posterior margin of sternum VII not sinuate laterally (fig. 2E); Brazil
 **vicosa** Oman
- 15 (12') Sternum VII not expanded laterally beyond pleurites (figs. 1E, 2E) ... 16
- 15'(12') Sternum VII expanded laterally beyond pleurites (figs. 7E, 9E, 10E, 11E) 17
- 16 (15) Length 4.5 mm. or more; Nearctic **novellina** Oman
- 16'(15) Length 4.1 mm. or less; Neotropical **vicosa** Oman
- 17 (15') Sternum VII very large, greatly expanded laterally beyond pleurites and often concealing 8th segment from direct ventral view; median emargination occupying about one-half of total width of sternum (figs. 11E, 10E, 7E) **abietaria**, n. sp., **ancistra**, n. sp., and **novella** (Say)
- 17'(15') Sternum VII slightly expanded laterally beyond pleurites but not concealing 8th segment; median emargination occupying more than one-half of total width of sternum (fig. 9E) **stella**, n. sp.

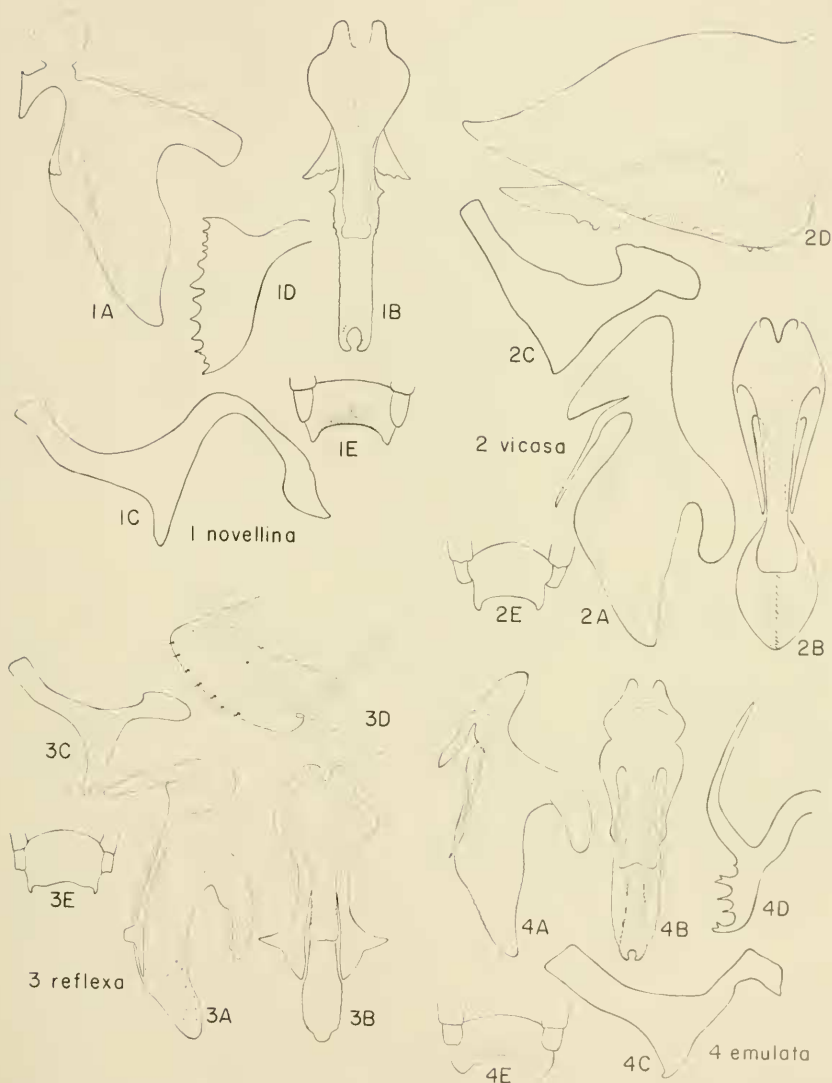
Agalliopsis novellina Oman

(Fig. 1)

Agalliopsis novellina Oman, 1935a:12.

One of the largest species of the *novella* complex; distinguishable from all others by the very short, vane-like aedeagal process and the large, ovate shape of the terminal part of the pygofer hook. Little difference in the size of the two sexes; males 4.4–4.7 mm. long; females 4.5–4.75 mm.

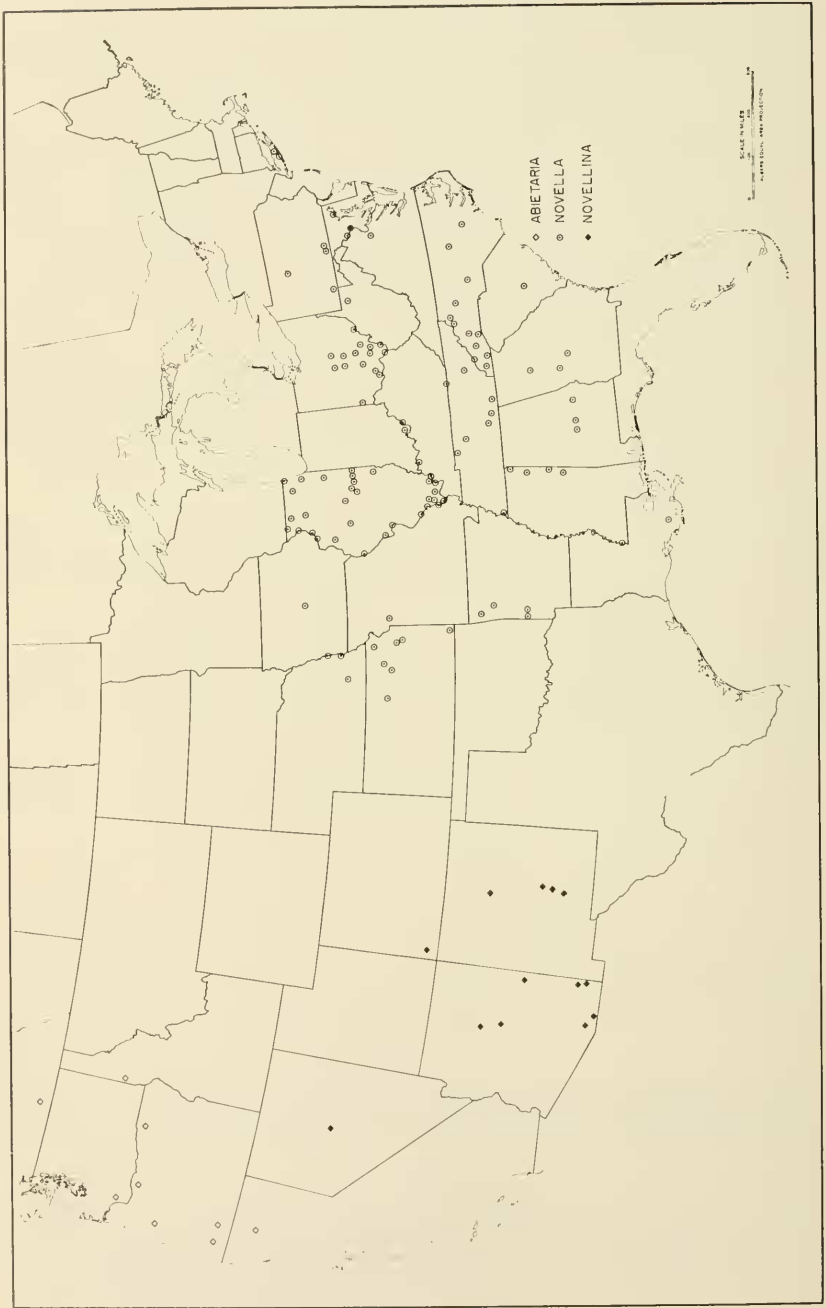
Aedeagus (figs. 1A, 1B) with basal process short and vane-like, posterior margin transverse and serrate; aedeagal shaft very broad basally in lateral view, tapering to a blunt point; in dorsal view stout, serrate laterally on distal two-thirds, expanded slightly just distad of basal processes. Xth segment (fig. 1C) large, curving mesad caudally, with the apex sometimes somewhat sinuate in caudal view; in lateral view tip expanded and bluntly pointed. Pygofer hook (fig. 1D) lying mostly below the arm, transversely in a nearly vertical plane although pitched slightly cephalad from dorsum to venter, mesal margin rather regularly, bluntly serrate; illustration from caudal and slightly ventral aspect.



Figs. 1-4, *Agalliopsis* species: 1, *novellina* Oman; 2, *vicosa* Oman; 3, *reflexa*, n. sp.; 4, *emulata* Oman. A = lateral view of aedeagus; B = dorsal view of aedeagus; C = Xth segment of ♂; D = pygofer hook; E = 7th sternum of ♀.

Female sternum (fig. 1E) VII broadly and shallowly emarginate, embrowned medially on posterior half, posterior lateral angles not strongly extended.

General ground color grey-cinereous to tawny, often rather contrastingly marked, the head and pronotal spots almost always present and well defined, pronotal spots sometimes faint.



Structural variations in the male genitalia of *novellina* are rare and of an inconspicuous nature. Two specimens examined (OSU), 1 from Flagstaff, Arizona, the other from Santa Rita Mts., Arizona, have the basal aedeagal processes reduced to short, pointed divergent spurs rather than the normal vane-like processes illustrated.

Distribution southwestern U. S. and probably adjacent Mexico. The type locality is Santa Rita Mountains, Arizona. Specimens examined are from mountainous areas in New Mexico, Arizona and Nevada. I have not seen examples of *novellina* from the Pacific northwest or from Utah or Idaho, and the records cited by Metcalf (1966a; 101) for those two states presumably apply to *ancistra*. The Pacific northwest records cited by Metcalf apply to *abietaria*, as does Beirne's record (1956a:14) of *novellina* from southern British Columbia. Beirne's figure 823 is clearly of *abietaria*. Occurrence records are shown in map 1.

Illustrations: 1A, 1B and 1E, Cochise Co. Ariz. (MWN); 1C and 1D, Carr Canyon, Ariz. (MWN).

Agalliopsis vicosa Oman, new status
(Fig. 2)

Agalliopsis novella var. *vicosa* Oman, 1938a:362.

Resembling *novella* but with a very broad aedeagal shaft, the pygofer hook broad and long, and female sternum VII narrower and only shallowly emarginate or subtruncate. Males 3.6–3.9 mm. long, females 3.9–4.1 mm.

Aedeagus (figs. 2A, 2B) with basal process short, about $\frac{1}{2}$ length of shaft, tapering to a point and in lateral view directed ventrad of the axis of the shaft; aedeagal shaft very broad in lateral view, distal one-third much broadened by keel-like lateral expansions ventrally. Xth segment (fig. 2C) distally terminating in a boot-shaped process somewhat like that of *emulata* but broader distally and directed more caudad than ventrad. Pygofer hook (fig. 2D) arising from caudo-ventral margin of pygofer above the apex of the styles, extending distad essentially parallel with the margin of the acuminate pygofer within which it lies in a plane about half between vertical and horizontal, caudo-ventral margin irregularly serrate; illustration from latero-ventral and slightly caudal view.

Female sternum VII (fig. 2E) narrower than in *novella*, posterior margin very shallowly emarginate or sometimes subtruncate.

Color essentially as in *novella* but with less extreme variation, the females tending toward tawny rather than cinereous in ground color, apex of anteclypeus sometimes fuscous. Forewing with the cells of the distal $\frac{1}{2}$ mostly brown or smoky excepting between the 2nd claval vein and commissural margin; R + M and a short section of R beyond the fork conspicuously brown in some specimens.

In addition to the type material from Vicosá, Minas Gerais, Brazil, I have examined the following specimens: 2 ♀♀, Campinas, Sao Paulo;

2 ♀♀ Salvador, Bahia; 1 ♂ San Jose dos Campos, Sao Paulo; 1 ♂ Ouro Preto, Minas Gerais; and 1 ♂ Foz do Iguaca Parana. All conform well, structurally, to the species as described.

Illustrations of the male structures are from the holotype from Minas Gerais, Brazil; 2E, Salvador, Brazil (USNM).

***Agalliopsis reflexa*, n. sp.**

(Fig. 3)

Resembling *tropicalis* but with pygofer hook reflexed so that serrations are on the cephalic margin; female sternum VII broadly and shallowly emarginate. Size as in *tropicalis*; males 3.6 mm. long, female 4.0 mm.

Aedeagus (figs. 3A, 3B) with basal process closely appressed to shaft, apically much expanded, the oblique latero-distal margin slightly incised; aedeagal shaft expanded laterally beyond apices of processes, surface of distal half set with numerous tiny retrorse corniculi. Xth segment (fig. 3C) with long ventral projection, free end expanded and bluntly rounded. Pygofer hook (fig. 3D) reflexed within the pygofer, broad basally with a short basal projection opposite point of attachment extending caudo-dorsally and tapering to a somewhat sinuate tip; meso-cephalic margin irregularly serrate; illustration depicts hook as seen through the pygofer from a lateral and slightly cephalic aspect.

Female sternum VII (fig. 3E) essentially like that of *tropicalis*, posterior margin broadly and shallowly emarginate, posterior lateral angles not strongly produced.

General ground color of males pale yellow with olive tinge, fuscous markings intense and with the pronotal spots and mid-line fused with a fuscous submarginal band on the pronotum, apex of anteclypeus fuscous, basal $\frac{1}{2}$ and disc of forewing infuscated; female yellowish cinereous, fuscous markings as in *tropicalis*.

Holotype male labeled "El Valle Venez 1421 C H Ballou, *Impatiens balsamina*, V-8-1939, G. vivas-B." Paratypes, 1 male and 1 female labeled "Mirasol near Cumanacoa, Sucre, Venez. G. Netting, Nov. 4, 1929, Carn. Mus. Acc. 8696." Types in the U. S. National Museum (type no. 70802).

The male from Sucre has the basal angle of the pygofer hook more prominent and the distal part of the aedeagus broader than in the holotype.

Illustrations: 3A, 3B, 3C and 3D from holotype; 3E from female paratype (USNM).

***Agalliopsis emulata* Oman, new status**

(Fig. 4)

Agalliopsis novella var. *emulata* Oman, 1938a:361.

Resembling *novella* but with aedeagal shaft broad and with lateral expansions ventrally, pygofer hook not L-shaped, and female sternum VII not deeply emarginate. Males 3.5–3.75 mm. long, females 4.0 mm.

Aedeagus (figs. 4A, 4B) with basal process closely parallel to shaft, about $\frac{1}{2}$ as long as shaft and tapering to slightly sinuate point; aedeagal shaft broad in lateral view, and with lateral keel-like expansions ventrally so the terminal two-



Fig. 5, *Agalliopsis tropicalis* (Van Duzee). A = lateral view of aedeagus; B = dorsal view of aedeagus; C = Xth segment of ♂; D = pygofer hook; E = 7th sternum of ♀.

thirds appears broad in dorsal view, lateral margins serrate, distal half with numerous corniculi dorsally. Xth segment (fig. 4C) terminating in a boot-shaped process with toe directed downward. Pygofer hook (fig. 4D) slender, with a mesally serrate extension below the arm and a slender, curved horn-like dorsal extension; hook not lying in a single plane, but oriented generally about 30° caudad from the transverse plane from arm to mesal margin, and about 45° from the horizontal with the dorsal extension farthest caudad; illustration from a latero-ventral and slightly caudal aspect.

Female sternum VII (fig. 4E) broadly and shallowly emarginate, posterior-lateral angles not strongly produced.

Color essentially as in *novella* but the extreme variations not present in material examined, apex of anteclypeus fuscous.

Known only from the type series from Loreto, Prov. Misiones, Argentine, collected on various dates from Nov. 29 to Dec. 18, 1931, by A. A. Ogloblin. Types in the U. S. National Museum.

Illustrations all from paratypes from Prov. Misiones, Argentina (USNM).

Agalliopsis tropicalis (Van Duzee), new status
(Fig. 5)

Agallia novella var. *tropicalis* Van Duzee, 1907a:53.

Much like *novella* but slightly smaller, with aedeagal process close to the aedeagal shaft, pygofer hook not L-shaped, and female sternum VII broadly and only shallowly emarginate. Length of males 3.4–3.6 mm., of females 3.6–4.0 mm.

Aedeagus (figs. 5A, 5Aa, 5B, 5Ba, 5Bb) with basal process rather closely aligned with shaft, diverging slightly distally, apex slightly expanded and sometimes roughly triangular in outline; aedeagal shaft slender, tapering gradually from middle to rather bluntly pointed tip, apically expanded in dorsal view, lateral

margins finely serrate, numerous retrorse corniculi on distal two-thirds dorsally. Xth segment (figs. 5C, 5Ca) resembling that of *novella* in general shape but terminating in a somewhat angular process, sometimes with vane-like projection mesally. Pygofer hook (figs. 5D, 5Da, 5Db) extending obliquely mesad, caudad and dorsad from its origin on the caudo-ventral margin of the pygofer, not directed sharply mesad as in *novella*; most of the hook dorsad of the arm but a prominent projection extending meso-ventrad also, mesal margin of hook irregularly serrate or dentate; illustration from latero-ventral and slightly caudal aspect.

Female sternum VII (fig. 5E) not so wide as in *novella*, broadly and shallowly emarginate posteriorly, the posterior margin laterally faintly to rather conspicuously sinuate, sometimes giving the impression of being notched.

Color essentially as in *novella* but lacking the extremes of variation; apex of anteclypeus fuscous.

The characterization of *tropicalis* is based on 5 males and 11 females from Jamaica, whence came Van Duzee's type material, and 6 males and 8 females from Costa Rica. As here interpreted *tropicalis* shows considerable variation in the structure of both the aedeagus and the pygofer hooks. In general, the Costa Rica specimens have the apices of the aedeagal processes more angled and the mesal margin of the pygofer hook less coarsely serrate. Fig. 5A represents the extreme variation observed in the arching of the basal aedeagal processes as seen in lateral view.

My record (Oman 1934c:453) of *tropicalis* from Mexico probably applies to *hamatilis*, n. sp.

Illustrations: 5A, 5B, 5C and 5D, St. Ann's Parish, Jamaica (USNM); 5Ba and 5Da, Mandeville, Jamaica (AMNH); 5Aa, 5Bb, 5Ca and 5Db, San Pedro de Montes de Oca, Costa Rica (USNM); 5E, Yallah's Valley, Jamaica (AMNH).

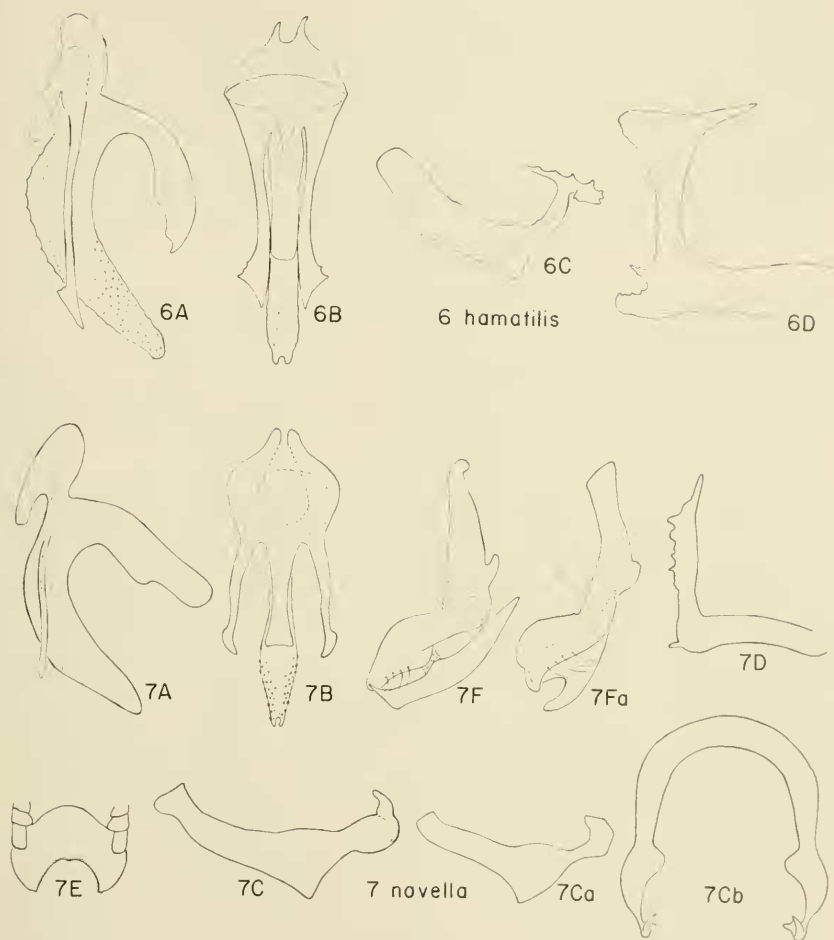
Agalliopsis hamatilis, n. sp.

(Fig. 6)

Resembling *novella* only slightly larger and with aedeagal process appressed to shaft of aedeagus and expanded distally; pygofer hook much larger than in *novella* and with distal part much expanded. Males 3.7 mm. long, female not known.

Aedeagus (figs. 6A, 6B) with basal process closely appressed to shaft, apex expanded and obliquely subtruncate; aedeagal shaft finely serrate ventrally and surface of distal half set with numerous tiny retrorse corniculi. Xth segment (fig. 6C) with caudal margin expanded and irregularly dentate. Pygofer hook (fig. 6D) very roughly L-shaped, the arm forming the base of the L, apex of hook greatly expanded with a pointed lateral projection; arm of hook extended mesad from pygofer and reaching to midline of genital capsule, dorsal extension of hook extending to opposite side of capsule, mesal margin with two prominent projections ventrally and with small irregularities dorsally; hook lying primarily transversely but with apex rotated slightly so that lateral angle lies caudad of mesal angle; illustration depicts caudo-ventral and slightly lateral aspect.

Female unknown; judging from the enlarged pygofer of male, female sternum VII should conform to the structure characteristic of the *novella* complex.



Figs. 6-7, *Agalliopsis* species: 6, *hamatilis*, n. sp.; 7, *novella* (Say). A=lateral view of aedeagus; B=dorsal view of aedeagus; C=Xth segment of ♂; D=pygofer hook; E=7th sternum of ♀; F=style.

General ground color of males yellowish with olive green tinge; dorsal fuscous markings distinct and typical of the *novella* complex; apex of anteclypeus and its distal lateral margins beyond lori fuscous.

Holotype male labeled "Taxco, Mex. 8-22-36 W. E. Stone 179." Paratype male labeled "Cuernv-Acap. Rd. Mex. 8-20-36 Ball & Stone 83." Types in the U. S. National Museum (type no. 70803).

The pygofer hooks of the two specimens studied show some variation, the specimen labeled Cuernava-Acapulco road having the ventral

mesal projection longer, more slender and hooked, and the distal lateral projection shorter. Illustrations are all from the holotype.

I believe the specimens from Guerrero, Mexico, that I identified as *tropicalis* (Oman 1934c:453) to be this species. I have reexamined the single male labeled "Amula, Guerrero, 6000 ft." and although one pygofer hook is completely missing and the terminal part of the other broken off, in all other respects the genitalic structures are as known for *hamatilis*. The specimens from Chilpancingo are all females.

***Agalliopsis novella* (Say)**

(Fig. 7)

Jassus novellus Say 1930b:309.

Macropsis nobilis Glover 1878a:2; pl. 2, fig. 1.

Of average size for the group; extremely variable in color but relatively uniform in structure; pygofer hook bent at a right angle, distal part directed dorso-caudad. Males 3.3–3.5 mm. long, females 3.75–4.0 mm.

Aedeagus (figs. 7A, 7B) with basal process not closely appressed to shaft, diverging slightly distally, slightly sinuate in dorsal view, apex somewhat expanded; aedeagal shaft smoothly curved dorsally, obliquely tapered from ventral margin to blunt tip, in dorsal view expanded at preapical one-third, lateral margins very finely serrate. Xth segment (figs. 7C, 7Cb) with caudal end terminating in a dorso-mesally directed point; usually but not always with one or two mesally directed teeth subapically on inner surface. Pygofer hook (fig. 7D) roughly L-shaped, with the base of the L formed by the arm and the hook extending dorsad, arm extending directly mesad from pygofer so the angles of the two hooks meet or slightly overlap at mid-line, hook lying transversely in a plane about 45° from the vertical with the apex caudad of the base of the L; mesal margin irregularly serrate or sometimes with only a few serrations; usually a slender spur-like projection at the lower mesal angle, although this may be absent; illustration from caudo-ventral aspect.

Female sternum VII (fig. 7E) with posterior margin broadly and deeply emarginate, the median part usually embrowned, posterior-lateral angles expanded.

General ground color ranging from pale cinereous to pale tawny, and fuscous to brown markings showing the entire range of color variation indicated for the *novella* complex. The color mutant that appeared in a culture of the species, described by Teitelbaum and Goulet, 1950a, has not been observed in nature although very darkly colored males are frequently found.

A. novella shows relatively little structural variation. The following are examples of some of the more extreme variants encountered.

A male from Doniphan Co., Kansas (UK) has the apex of the Xth segment attenuated, the spur at the meso-ventral angle of the pygofer hook unusually long and curved, and the basal aedeagal processes arising rather close to the shaft and with lateral margin angular subapically. A "maroon" specimen from the Boyce Thompson Institute culture, 1964 (MWN), also has the aedeagal processes close to the shaft. This same "maroon" specimen exhibits another variation that

appears frequently in "maroon" specimens, i.e. the apex of the Xth segment is broad and blunt. The extreme of this variation observed is in a "maroon" specimen (USNM) taken from Black's culture in June 1969 (fig. 7Ca); similar but less extreme variation of this nature occurs in some specimens (USNM) taken from Black's culture April 1, 1949. This structural variation has not been observed in "normal" specimens from cultures; on the contrary, they tend to have the lateral terminal projection of the Xth segment, which is directed dorsad, longer and sharper than in wild populations, and the mesally directed tooth more prominent.

This is "type G" of my 1933 paper. It is by far the commonest species in the east central region of the United States and I believe it to be the species to which Say applied the name *novella*. Say's type material was presumably destroyed; the type locality is Indiana, presumably in the vicinity of New Harmony. I also consider Glover's name *nobilis* to apply to this species.

Agalliopsis novella occurs from South Carolina to northern New Jersey in the eastern United States and thence westward to eastern Nebraska, Kansas, Oklahoma and Texas. Occurrence records are shown on map 1. As Ball (1936f:650) has pointed out, *novella* is replaced in the extreme southeastern United States by *vellana*. In the south central United States *novella*'s distribution slightly overlaps that of *stella*, which is the dominant species in Texas. In some parts of the east and midwest, *novella* and *ancistra* occur in the same areas; whether or not in identical habitats is not known.

Nielson's illustrations (1968a:37, fig. 9) quite evidently apply to *vellana* rather than *novella*. Beirne's illustrations (1956a:153, fig. 822) of male genitalic structures identified as *novella* apply to *ancistra*. It also appears that Beirne's habitus illustrations of species of *Agalliopsis* (l. c. : 121, figs. 23 & 24) have been inadvertently transposed. His fig. 23, labeled *novella*, probably represents either *abietaria* (= *novellina* Beirne not Oman) or *ancistra*, while his fig. 24, labeled *novellina*, appears to be *novella* as here interpreted.

Since 1943, as a result of the work of L. M. Black and associates, and subsequently of other investigators concerned with inter-relationships of agallian leafhoppers and plant pathogens, there has accumulated an enormous literature dealing with *novella*. So far as I am aware, all published references relating to *novella* in relation to plant pathogens apply to the species as here interpreted. Black's experimental colony of *novella* (Black 1944a) was established from nymphs collected by Black and myself in October 1941 in the vicinity of Washington, D. C. and from a locality about half way between Washington, D. C. and Annapolis, Maryland, adjacent to former U. S. highway #50. Adults reared from those nymphs were identified by me in 1942 as "*novella*

type G" and are in the U. S. National Museum collection. During the course of this study I have re-examined those specimens, and also samples of progeny of the 1941 generation taken in 1947, 1949, 1964 and 1969 from colonies maintained by Black at the Brooklyn Botanic Gardens and the University of Illinois, and by Karl Maramorosch and associates at the Boyce Thompson Institute for Plant Research. All are *novella* as here described.

Illustrations: 7A, 7B, 7C and 7D, Black's Brooklyn Botanic Garden culture 1947 (UA); 7Ca, "maroon" strain variant, Black's Univ. Illinois culture 1969; 7Cb, Douglas Co. Kansas (UK); 7E, Washington, D. C. (USNM); 7F and 7Fa, Douglas Co., Kansas (dorso-mesal and latero-ventral views, respectively, of left style) (UK).

***Agalliopsis vellana* Ball**

(Fig. 8)

Agalliopsis vellana Ball, 1936f:649.

The smallest of the *novella* complex, and distinguishable from all others by the inner anteapical cell of the forewing being closed basally, a character that it shares with members of the *variabilis* group. Males 3.0 mm. long, females 3.5 mm.

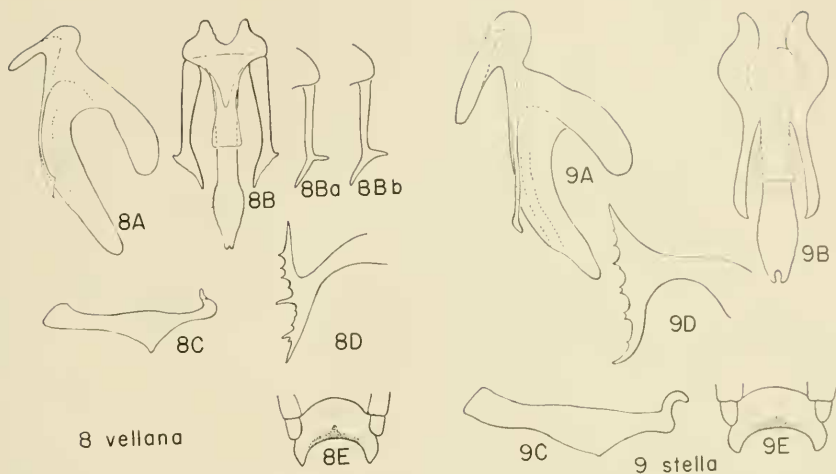
Aedeagus (figs. 8A, 8B) with apex of basal process expanded, broad, flat and obliquely truncate or sometimes with an angular margin distally (figs. 8Ba, 8Bb); aedeagal shaft narrowed distally in lateral view, considerably expanded on the distal one-third in dorsal view, with the margins of the expanded part finely serrate, corniculi present on dorsal surface. Xth segment (fig. 8C) terminating in a stout, pointed, dorsally-directed tooth, or rarely with tooth absent and distal end of segment rounded. Pygofer hook (fig. 8D) about equally above and below the arm, lying transversely at about a 45° angle from the vertical, mesal margin very irregularly serrate; illustration from a caudo-ventral aspect.

Female sternum VII (fig. 8E) with hind margin broadly and shallowly emarginate, middle one-third to three-fifths of margin embrowned, posterior-lateral angles slightly attenuated.

There is evidence of some venational instability in the forewing of *vellana*. Extra cross-veins are often present in the region of the inner anteapical cell, and the position of the cross-vein forming the base of that cell is variable. I have seen 3 females (UK) labeled "Pensacola Fla 7-12-34 R. H. Beamer" that have no trace of a cross-vein closing the inner anteapical cell basally. I believe these specimens are examples of *vellana*.

A. vellana is the only species of the *novella* complex known from Florida. I have seen numerous specimens from the approximate localities shown on Map 2. I have also seen a single female specimen (UK) labeled "Natchitoches Co. La. 8-16-38, R. H. Beamer" that appears to be *vellana*.

Illustrations: 8A, 8B, 8C and 8D, Tampa, Florida; 8Ba and 8Bb, Ft. Meade, Florida; 8E, Elfers, Florida (UK). Nielson's illustrations of



Figs. 8-9, *Agalliopsis* species: 8, *vellana* Ball; 9, *stella*, n. sp. A = lateral view of aedeagus; B = dorsal view of aedeagus; C = Xth segment of ♂; D = pygofer hook; E = 7th sternum of ♀.

genitalic structures of a Florida specimen (1968a:37, fig. 9) identified as *novella* apply to *vellana*.

***Agalliopsis stella*, n. sp.**

(Fig. 9)

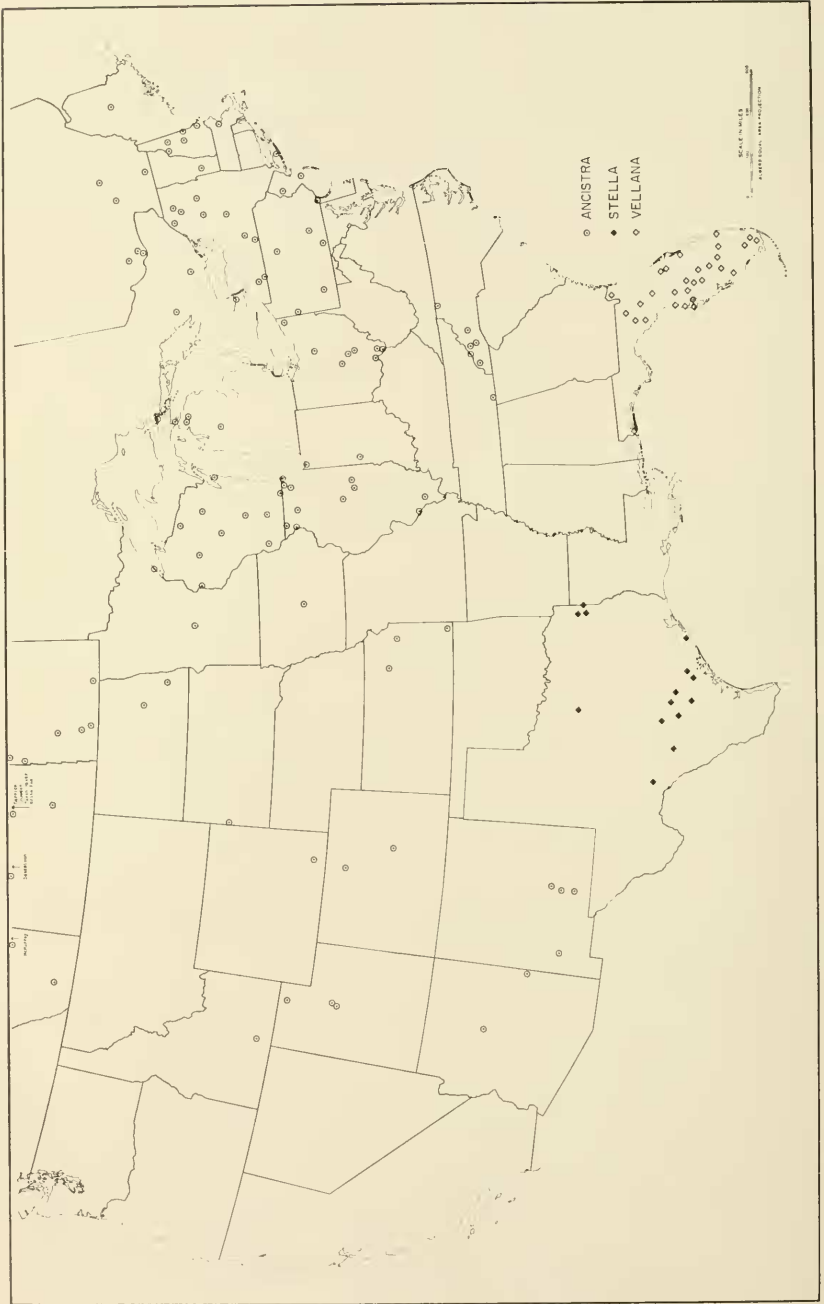
Resembling *vellana* in general appearance, but slightly larger and paler, the inner anteapical cell of forewing not closed basally, and aedeagal process not obliquely subtruncate. Males 3.2-3.4 mm. long, females 3.5-3.75 mm.

Aedeagus (figs. 9A, 9B) with basal process slightly sinuate, apex narrowed from outer margin to blunt point, occasionally rather sharply pointed; aedeagal shaft only slightly expanded distally, with numerous corniculi on dorsal surface. Xth segment (fig. 9C) terminating as a rather slender extension curved upward and then downward to form a definite hook. Pygofer hook (fig. 9D) larger below the arm than above, lying transversely in a vertical plane, or sometimes tilted only slightly obliquely from the vertical, mesal margin irregularly serrate; illustration is from a caudal view.

Posterior margin of sternum VII of female broadly and shallowly emarginate, median $\frac{1}{3}$ of emargination yellowish-brown, posterior-lateral angles bluntly rounded, not greatly expanded.

General ground color pale yellow, head and pronotal spots usually distinct, fuscous; males seldom showing a tendency toward darkening of other areas except for midline on pronotum.

Holotype male and 1 male and 1 female paratype from Concan, Texas, June 4, 1933, P. W. Oman. Other paratypes from the same locality collected July 6, 1936 by R. H. Beamer and D. R. Lindsay. Types in the U. S. National Museum (type no. 70804), paratypes in the University of Kansas Collection.



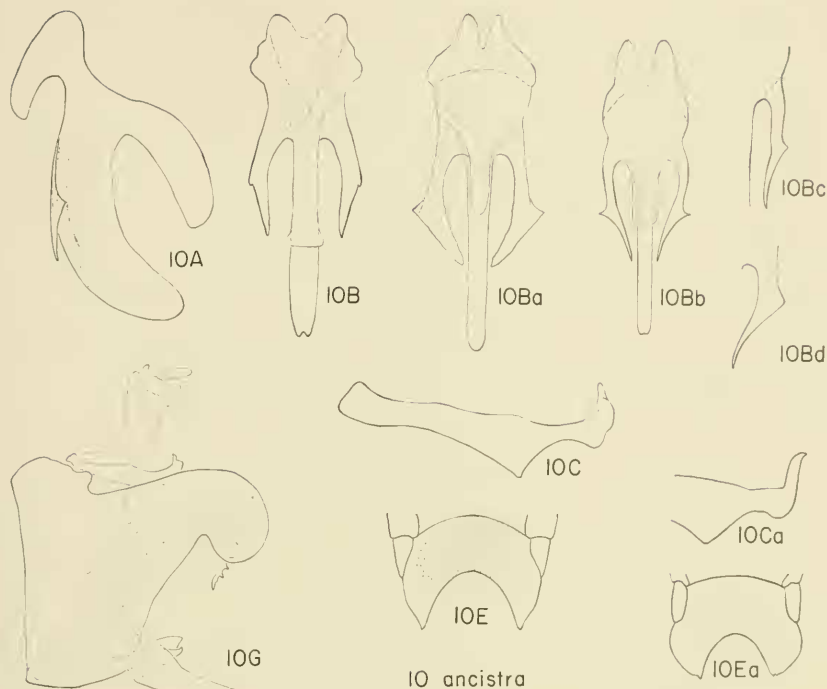


Fig. 10A, B, C, E, G, *Agalliopsis ancistra*, n. sp. A = lateral view of aedeagus; B = dorsal view of aedeagus; C = Xth segment of ♂; E = 7th sternum of ♀; G = genital capsule of ♂.

This is the "type H" of my 1933 paper. In addition to the type series I have examined many other specimens from the following localities: Texas-Barton, Boerne, Brazoria Co., Devils River, Jefferson, Karnes Co., Palopinto Co., San Antonio, Sequin, Victoria; Louisiana—Caddo Par., Natchitoches Par., Houma. I have also seen 1 female (UK) labelled "Wichita N.F." [? Ouachita National Forest?] Okla. 6-28-36 R. H. Beamer that I believe to be this species. Occurrence records are shown in map 2.

Illustrations all from paratypes from Concan, Texas (UK).

***Agalliopsis ancistra*, n. sp.**

(Fig. 10)

Resembling *novella* in general habitus but slightly larger and paler, the aedeagal process obliquely subtruncate distally and the pygofer hook not L-shaped. Usually

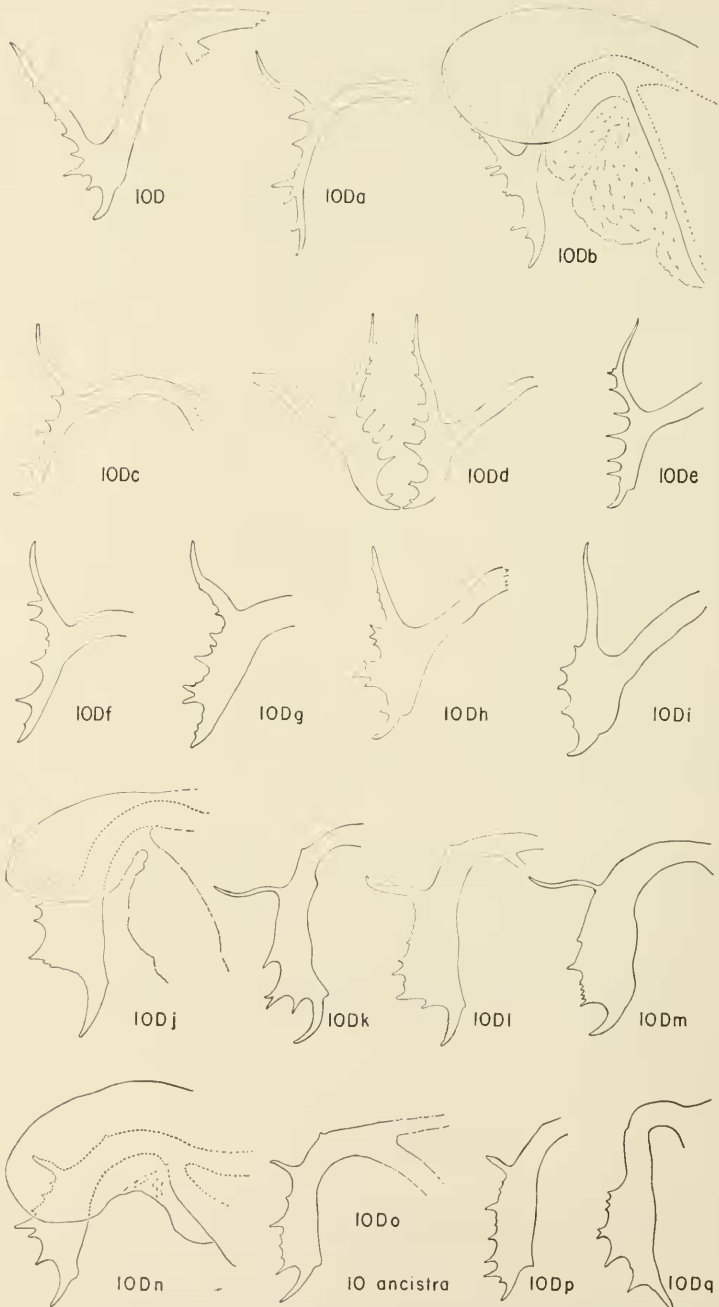


Fig. 10D, *Agalliopsis anacistra*, n. sp. D = pygofer hook with variations.

little size difference in the sexes, although the size ranges are males 3.5–4.0 mm. long; females 4.0–4.3 mm.

Aedeagus (figs. 10A, 10B, 10Ba, 10Bb, 10Bc, 10Bd) with apex of basal process obliquely truncate and sometimes greatly attenuated; aedeagal shaft thin, but broader than that of *novella* in lateral view and with tip more bluntly rounded, distal part not expanded or at most very slightly so, dorsal surface distally often with a few corniculi. Xth segment (figs. 10C, 10Ca) terminating in dorsally directed spine-like process which is sometimes considerably attenuated. Distal part of pygofer hook exceedingly variable (figs. 10D through 10Dq) but with the arm long and extending caudo-ventrad and slightly mesad from point of attachment to pygofer; distal part of pygofer hook lying primarily in a vertical and longitudinal plane, but with caudal margin and ventral tip slightly nearer the median line; illustrations from a lateral and slightly caudo-ventral aspect.

Sternum VII (figs. 10E, 10Ea) of female very large, with a deep, median U-shaped emargination. There may sometimes be a shallow notch at the base of the emargination which give the emargination a slightly V-shaped appearance which may be accentuated by a submarginal brown line.

Color essentially as in *novella* but usually less marked with fuscous and the ground color, especially of the females, sometimes tending toward tawny more than cinereous; males seldom showing the extreme fuscous coloration found in the darker males of *novella*. Spots on head and pronotum usually present and definite, the males sometimes with the pronotum entirely fuscous except for a pale posterior border and pale areas adjacent to the anterior $\frac{2}{3}$ of midline and anterior to pronotal spots; in such specimens the forewings usually fuscous to smoky with contrasting broadly pale veins in clavus and on disc. Female sternum VII often brown or fuscous basally, or occasionally almost entirely so.

Holotype male labeled "Green Mts. near Rutland, Vt., June 21, 1933, John L. Buys." Paratypes, 7 males and 13 females from Vermont with same data as holotype, and the following specimens from New York state collected by Buys: Canton—1 male, 1 female June 2, 1927; 1 male, 1 female July 21, 1927; Santa Clara—1 male, 8 females June 9, 1927. Types in the U. S. National Museum (no. 70805).

This is by far the most variable and puzzling taxon of the *novella* complex. In contrast to the other species recognized, *ancistra* exhibits extreme variation in the shape of the pygofer hook and, to a lesser extent, in the shape of the basal processes of the aedeagus; the aedeagus and Xth segment of the male and sternum VII of the female vary little.

I have examined 1 specimen (CNC) from White Fox, Saskatchewan that appears to be an intersex, and 1 male (CNC) from Torch River, Saskatchewan that has the aedeagus similar to the Penaleno, Arizona specimen (figs. 12A, 12B) of *Agalliopsis* sp. Both these Saskatchewan specimens bear pin label data identical with that of normal *ancistra* specimens.

Figures 10D–10Dq illustrate some of the many shapes the pygofer hook may assume in this species, and there is even considerable variation within a single individual as shown in fig. 10Dd, which is of the two

hooks in a specimen from Spirit Lake, Iowa. In general, the hooks of specimens from the south central part of the species' range tend to be more slender (figs. 10De, 10Df), while those from northern latitudes tend to have broader hooks. The thin dorsal process of the hook (figs. 10Dk, 10Dl, 10Dm) may be either present or absent; sometimes it has been broken off, judging from the condition of the margin of the hook at what would have been the point of attachment, but in other specimens the process appears to be naturally absent. Two specimens examined have the dorsal process present on the hook on one side, but absent from the hook on the opposite side, without evidence of the missing processes having been broken off.

Variation in the shape of the basal process of the aedeagus, illustrated in figs. 10B-10Bd, is largely in the width/length proportions, and degree of attenuation of the tip. The obliquely truncate distal margin is sometimes finely serrate.

Specimens from a single locality or region tend to be relatively uniform in the shape of the pygofer hooks and other variable structural characters. However, samples from a few localities show virtually the entire range of variation described for the species as, for example, the males in a series of 10 males and 5 females from Ninette, Manitoba, collected in 1958 by J. F. McAlpine (CNC). The males were taken on various dates from May 9 to June 3? (numeral for date in June not clear), but there is no correlation between the structural differences observed and the dates upon which individuals were collected. Examination of 7 dissected males revealed the following: 1 has the pygofer hook as illustrated (fig. 10Dp) and the basal aedeagal process stout but attenuated; 1 has the pygofer hook essentially as illustrated (fig. 10Dl) and the basal aedeagal process attenuated apically but not stout; 1 has the pygofer hook intermediate in shape between fig. 10Dl and a specimen from Green Mts. near Rutland, Vermont (fig. 10Dh); 1 like the preceding but with the dorsal part of the hook at more of an angle to the main axis of the hook; 1 with pygofer hook closely resembling a specimen from Algonquin, Illinois (fig. 10Dk); and 1 with pygofer hook essentially as in the White Fox, Saskatchewan specimen illustrated (fig. 10Dq) and without any evidence of the dorsal part of either hook having been broken off.

Map 2 shows occurrence records for the 384 specimens of *ancistra* examined. The records from Arizona, Colorado, New Mexico, North Carolina and Tennessee are all from mountainous regions, so far as can be determined from the sometimes rather cryptic data on the labels. This species occurs primarily in northern latitudes and high elevations. Exceptions to this generalizations are the records from southern Illinois (Carbondale) and eastern and east-central Kansas (Cherokee Co., Douglas Co. and Manhattan). The Kansas specimens and some others

from the southern part of the range in the central states tend to be slightly smaller and paler than specimens from more northern localities. This condition is usually, though not consistently, associated with the more slender pygofer hook variation. It may well be that the mid-western populations deserve recognition as a subspecies.

Collection records for adults are from April 16 (Manhattan, Kansas) to August 22 (Payson, Utah). Most of the records are for the period May through July.

This is "types F and J" of my 1933 paper. Beirne's illustrations (1956a:153, fig. 822) labelled *novella* apply to *ancistra*.

Illustrations: 10A, 10B and 10C, Canton, New York (USNM); 10Ba, White Fox, Saskatchewan (CNC); 10Bb and 10G (genital capsule), Manhattan, Kansas; (KSU); 10Bc, and 10Ca, White Heath, Illinois (INHS); 10Bd, "N. Colo." (UK); 10E, Rutland, Vermont (paratype) (USNM); 10Ea Riley Co., Kansas (KSU); 10D, Carp, Ontario (CNC); 10Da, "N. Colo." (UK); 10Db, Joliette, Quebec (AMNH); 10Dc, Cassville, New Jersey (AMNH); 10Dd, Spirit Lake, Iowa (both pygofer hooks) (CNC); 10De, Manhattan, Kansas (KSU); 10Df, White Heath, Illinois (INHS); 10Dg, Ames, Iowa (OSU); 10Dh, Rutland, Vermont (holotype) (USNM); 10Di, Canton, New York (USNM); 10Dj, Great Smoky Mountain National Park, Tennessee (OSU); 10Dk, Algonquin, Illinois (INHS); 10Dl, Ninette, Manitoba (CNC); 10Dm, Oregon, Illinois (INHS); 10Dn, Algonquin, Illinois (INHS); 10Do, Zion, Illinois (INHS); 10Dp, "Colo. 1963" (INHS); 10Dq, White Fox, Saskatchewan (CNC).

Agalliopsis abietaria, n. sp.

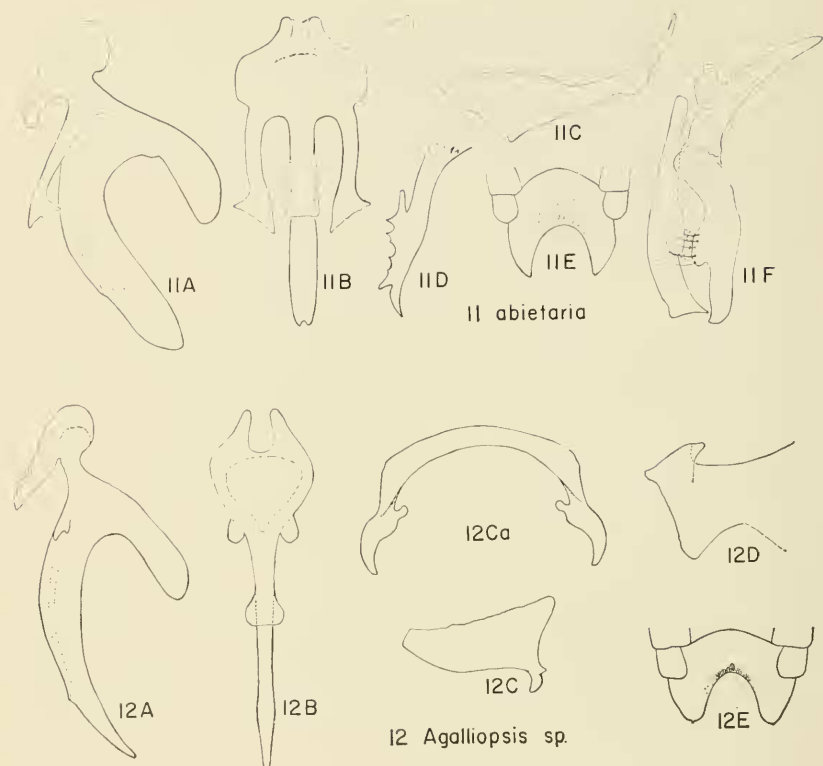
(Fig. 11)

Intermediate in size between *novella* and *novellina*, differing from the former in having the aedeagal process broad and obliquely subtruncate distally and the pygofer hook extending ventrad; from the latter in having aedeagal process about half as long as the aedeagal shaft, and the pygofer hook slender. Males 3.8–4.24 mm. long, females 4.0–4.5 mm.

Aedeagus (figs. 11A, 11B) with basal process not closely appressed to shaft, comparatively shorter than in *novella*, extending about $\frac{1}{2}$ the length of the aedeagal shaft but directed obliquely ventrad below the plane of the shaft so that it appears shorter when viewed from above, obliquely subtruncate; aedeagal shaft only slightly expanded distally, very finely serrate laterally. Xth segment (fig. 11C) with end attenuated, curved slightly dorsad. Pygofer hook (fig. 11D) extending obliquely downward from point of attachment to pygofer to midline at an angle of about 45° , the hook lying in a plane parallel to the long axis of the body, caudal margin very irregularly serrate or dentate; illustration from latero-ventral aspect.

Female sternum VII (fig. 11E) with a median U-shaped emargination, as deep as in *novella* but not so wide, posterior-lateral angles well produced.

General ground color cinereous to tawny, fuscous or brown markings as described for the *novella* complex but lacking the extremes.



Figs. 11-12, *Agalliopsis* species: 11, *abietaria*, n. sp.; 12, un-named species. A = lateral view of aedeagus; B = dorsal view of aedeagus; C = Xth segment of ♂; D = pygofer hook; E = 7th sternum of ♀; F = style.

Holotype male and numerous paratypes of both sexes from the Oak Creek area of MacDonald Forest, near Corvallis, Oregon, May 7, 1969, Paul Oman. Types in the U. S. National Museum (no. 70806). Numerous additional paratypes same locality and collector as holotype, taken on April 28, 1968 and May 4, 1969. The species has also been taken at other localities in the general vicinity of Corvallis by several collectors. All these localities are in or near fir forests. I encountered it in a similar habitat in the mountains east of Medford, Oregon, May 18, 1968.

This species evidently has but a single generation a year. Adults have been taken in Oregon from April 28 to June 9; nymphs on November 13 (V. Roth) and November 14 (K. M. Fender).

Beirne's illustrations (1956a:153, fig. 823) labelled *novellina* apply to this species; *novellina* is not known to occur in the Pacific Northwest. Occurrence records for *abietaria* are shown on Map 1.

All illustrations are from specimens from MacDonald Forest near Corvallis, Oregon (USNM).

Agalliopsis sp.

The description that follows is based upon a series of 2 male and 19 female specimens labeled "Pinaleno M., Ar., VI-27-39, D. J. & J. N. Knull, Collrs." in the Ohio State University collection. The specimens were at first thought to be representatives of *novellina* in which some of the structures of the male genitalia had failed to develop normally, but sternum VII of the female is similar to that of *ancistra* rather than *novellina* although they agree in size and general appearance with *novellina*. The specimens may represent an *ancistra* × *novellina* hybrid population.

Superficially identical with *novellina* Oman but with aedeagus slender, aedeagal process and pygofer hook rudimentary, and female sternum VII deeply emarginate. Males 4.0–4.4 mm. long, females 4.5–4.75 mm.

Aedeagus (figs. 12A, 12B) more slender than in *ancistra* with basal process reduced to short, oval knob in one male, entirely absent in the other; aedeagal shaft slender with only very faint indications of tiny corniculi dorsally toward distal end. Xth segment (figs. 12C, 12Ca) very short, about one third the length of the genital capsule, terminating in blunt, ventrally directed point. Pygofer hook (fig. 12D) consisting of a small, weakly sclerotized subquadrate process on the inner caudo-ventral face of the pygofer; illustration depicts caudo-lateral view, in which position the dorsal portion lies within the pygofer.

Female sternum VII (fig. 12E) large, as in *novella*, with median emargination as deep but not so wide as in that species.

Color as in *novellina*.

All illustrations are from specimens from Pinaleno Mts., Arizona (OSU).

REFERENCES

- Beirne, B. P. 1956a. Leafhoppers (Homoptera: Cicadellidae) of Canada and Alaska. *Can. Ent.* 88, Suppl. 2, 180 pp.
- Kramer, J. P. 1960a. A remarkable new species of Neotropical *Agalliopsis* and the previously unknown male of *Agalliopsis inscripta* Oman (Homoptera: Cicadellidae: Agalliinae). *Proc. Biol. Soc. Wash.* 73:63–66.
- . 1964a. New World leafhoppers of the subfamily Agalliinae: A key to genera with records and descriptions of species (Homoptera: Cicadellidae). *Trans. Amer. Ent. Soc.* 89:141–163.
- Metcalf, Z. P. 1964a. General Catalogue of the Homoptera. Fasc. VI Cicadelloidea. Bibliography of the Cicadelloidea (Homoptera: Auchenorrhyncha). Agric. Res. Serv., U.S. Dept. Agric., 349 pp.
- . 1966a. General Catalogue of the Homoptera. Fasc. VI Cicadelloidea. Part 14 Agalliidae. Agric. Res. Serv., U.S. Dept. Agric., 173 pp.
- Nielson, M. W. 1968a. The leafhopper vectors of phytopathogenic viruses (Homoptera: Cicadellidae). Taxonomy, biology and virus transmission. Tech. Bull. No. 1382, Agric. Res. Serv., U.S. Dept. Agric., 386 pp.